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Description

This invention relates to non-woven material useful, for example, for disposable wipers for industrial or domestic purposes, for filtration or for disposable protective clothing.

A material has been disclosed in U.S. Specification No. 4,100,324 which comprises meltblown polymeric microfibres intermixed with wood pulp fibres, the wood pulp fibres being interconnected by and held captive within the matrix of microfibres by mechanical entanglement and interconnection of the microfibres and wood pulp fibres. The wood pulp fibres may be replaceable by other suitable length fibres of cellulose material e.g. textile fibres. Absorbent or super-absorbent particles may replace the absorbent fibres or be present in addition to absorbent fibres. See also U.S. Patent No. 4426417 and European Patent Application No. 0080382. Such material will hereafter be referred to as "material of the type described".

It is desirable for wipers, for example, to have the ability rapidly to absorb fluids including oil, readily to be squeezed out and subsequently to absorb further fluid without leaving smears on a surface which has been wiped. It is also desirable that the material has an integral strength to prevent break-up of the wiper when wet and to have a substantially lint free wiping surface.

US Patent No. 4370289 describes a web of alternate layers of wood pulp fibres and meltblown fibres.

European Patent Application No. 0159630 (relevant under Article 54(3) EPC only) describes the formation of a three layer laminate material, the layers comprising intermixed meltblown fibres and, preferably, wood pulp fibres, the centre and one outer layer only having super-absorbent particles dispersed therethrough.

Non-woven laminate material in accordance with the invention comprises a layer of meltblown polymeric microfibres intermixed with fibres of absorbent material and/or absorbent particles but excluding super-absorbent particles, the absorbent fibres and/or particles being inter-connected and held captive within the polymeric microfibre matrix by mechanical entanglement and interconnection between the microfibres and absorbent fibres (when present) characterised in that the layer of meltblown polymeric microfibres and absorbent fibres and/or particles (18) is sandwiched between two outer layers (8,20) of meltblown polymeric microfibres without absorbent fibres and/or particles, the microfibres in each of the three layers being bonded to the fibres in an adjacent layer by fuse bonds (26) extending through the material and produced ultrasonically or by the application of heat or heat and pressure.

The material largely satisfies the above desiderata and comprises a layer of material of the type described and two layers of meltblown polymeric microfibres (without pulp or fibres being intermixed therewith).

The polymeric microfibres may be bonded together throughout the material as these are present in each of the layers.

With material in accordance with the invention, the layers may be bonded ultrasonically but are preferably bonded together by the application of heat and pressure through, for example, heated calander rolls having an engraved bond pattern. With three layers, this causes the microfibres in the outer layer to bond to the microfibres in the central layer so as to produce fuse bonds which extend through the web. An integrally bonded strong web is thus produced, with the absorbent fibres or pulp in the centre layer being held firmly anchored in position and prevented from moving to form lumps or bumps.

Alternatively the layers may be bonded together by passing heated air through the material, the temperature of the air being such as to bond the polymeric fibres in the layers to all other contacting fibres.

The non-woven laminate material has the clean wiping characteristics typical of meltblown materials due to the fact that the surface layers are comprised wholly of polymeric microfibres. The surface layers also give the product a good durability with low linting. The incorporation of the absorbent fibres or pulp in the central or core layer provides economy, high bulk and better fluid absorption and wringability characteristics as compared with wholly meltblown material.

Different materials may be used for the outer layers depending upon the durability or other surface characteristic required. For example, the outer surface may be made of polyester, nylon and polyethelene in various weights and fibre diameters. However, the preferred material for the outer layers is polypropylene. If, for example, polyester fibres are used in the outer layers then the fibres in the centre layer should have the same melting point if the three layers are being bonded by compression using heated rollers. However, different materials may be used if ultrasonic bonding is employed. Thus one could envisage a material having nylon fibres in one outer layer, a central layer including polypropylene fibres and the other outer layer also having fibres of polypropylene or low density polyethylene. Different materials may be used according to the envisaged end use of the resultant laminated product which may extend to drying cloths or fabrics, wipers or for medical applications and protective clothing.

The total weight of the laminated web material in accordance with the invention may vary considerably. A typical weight would be 85 grams per square metre but the weight could, for example, be as low as 50 and as high as 150 g/m^2(gsm). The outer layers may for example have a weight of 15 gsm (with a central layer weight of 55 gsm) but their mimimum weight could be about 10 gsm depending on the requirements of the material. If high absorbency is required then one needs a high bulk content for the centre layer which, for example, could include a wood pulp content of 50 to 80 percent or even more by weight.

However, the fibre content in the centre layer must be such as to allow bonding between the polymeric fibres in the three layers.

The bonding area may be as low as 10 percent or even lower but is preferably about 12½ percent. The bonding area could however be much higher although this would provide a stiffer and much harder product.

The fibre diameters of the polymeric material in the outer layers are, for example, from about 1½ to 10 microns. They may be about say 2½ microns to give a soft surface, useful for wiping sensitive surfaces, which are fairly common in, for example, the electronic

With the preferred embodiment if higher diameter (say from 4 to 5 microns) fibres are used in the outer layers the web material is coarser but has a rather better absorption rate and transfers fluid to the core material where it is retained. Such material may, for example, be used to wipe up printing ink. The fibres in the central layer may not be the same size as those in the outer layer. Normally fibres having 10 microns diameter would be considered as of maximum size.

As an example, the following material has been found to be particularly good as a printer's wipe.

The first layer of wholly meltblown polypropylene microfibres is of 15 gsm. The second or central layer consists of 50 percent by weight of polypropylene meltblown microfibres and 50 percent wood pulp giving a layer of 55 gsm. The third or outer layer is the same as the first layer namely, 100 percent polypropylene meltblown microfibres of 15 gsm. The material is treated with surfactant to provide water absorption properties.

In use the surface of the web has a dry feel due to the fact that the microfibres in the outer layer wick fluid away from the surface into the centre layer. The cellulose in the central layer has a very high natural affinity for water which is absorbed into the fibres, compared with polypropylene which is normally hydrophobic and only retains water between the microfibres through use of a surfactant.

The invention will now be further described by way of example with reference to the accompanying diagrams in which:-

Figure 1 is a schematic view of apparatus suitable for making material in accordance with the invention, and

Figure 2 is a diagrammatic cross-section through material in accordance with the invention.

Referring to Figure 1 polypropylene is formed through standard formers 2 and issues through the use of standard well-known equipment 4 as meltblown microfibres 6, 6' and 6". The first layer of meltblown microfibres is laid at the righthand end of a forming wire 10, to move from right to left as seen in Figure 1, to form a flat layer 8 on the wire 10. The central layer is produced partly of the meltblown microfibres 6' and partly of wood pulp which is fed from pulp reels 12 to a rotary pulp picker 14 from which the 'picked' pulp is blown through a nozzle 16 to mingle with the meltblown microfibres 6' to form a layer 18 consisting of an intimate mixture of pulp and meltblown microfibres. The other outer layer 20 is formed by meltblown polypropylene microfibres 6" which are laid on top of the central layer 18 at the lefthand end of the forming wire 10.

The three layers 8, 18 and 20 are then fed between two heated rollers 22, one of which is engraved with a bonding pattern to produce compression points and hence fusion bonds between the polymeric fibres in the three layers which are compressed together to emerge as a single laminate 24.

The resulting material is illustrated in Figure 2 on a larger scale, and it can be seen that at the bond areas 26 the polymeric fibres in all three layers are fused together to produce strongly bonded material in which the fibres in the centre layer are held captive.

It will be appreciated that the absorbent pulp in the centre layer may be replaced wholly or partly by fibres and/or synthetic Pulp such as that made of polyolefin fibrillated pulp available in the form of polyethylene or polypropylene under the trading name "Pulpex" made for example by Lextar, a Solvay-Hercules Company, of Rotterdam, Netherlands. Synthetic pulp as it is thermoplastic may give improved layer bonding.

As an example the three layers may have the following comparative thickness for a laminate having a weight of 85 gsm.

The two outer layers of meltblown microfibres - 225 microns.

The centre layer of material of the type described - 460 microns comprising 70% pulp 30% polymer.

The outer layers bad a weight of 20 gsm with the centre layer having a weight of 45 gsm.

The embossing pattern may be of any convenient shape or pattern e.g. diamond shaped areas as illustrated see Figure 3 or of areas simulating a woven web see Figure 4.

The material may, as indicated above, be used for a variety of purposes as follows:-

1) WIPERS

A laminate comprising an abrasion resistant, solvent resistant polyester, polypropylene or nylon meltblown outer layer with an absorbent pulp/polypropylene microfibres centre layer.

2) WORKWEAR

A fabric structure comprising durable nylon or polyester meltblown outer layers with a textile-like, opaque layer of staple fibres containing polypropylene microfibres for the centre layer.

3) OTHER APPLICATIONS

Other applications are possible if the laminate has dissimilar outer layers e.g. face mask media, and medical fabrics.

4) DRYING CLOTH

Nylons or polyester meltblown outer layers for durability and temperature resistance with an absorbent pulp or staple fibre centre layer containing polypropylene microfibres could be used as a disposable tea towel.

An advantage of such a construction would be the ability for moisture to be preferentially transferred to the centre layer, giving relatively "dry" outer surface layers.

The following comparison table is intended to show the relatively high absorbency and "mop-up" capacity of material in accordance with the invention as compared with material made of 100 percent meltblown polymeric material and material comprising two outer layers of material of the type described sandwiching a single central layer of spunbond polymeric material.

(FOOD SERVICE WIPER)

	MCM	CSC	(100% MELTBLOWN)
Basis weight (gsm)	85	80	82
Construction	15/55/15	33/14/33	Pure meltblown
Pulp/polymer ratio	70/30	30/70	100% Polypropylene
Water Absorbency			
Absorbent capacity (%)	615	675	485

Mop-up capacity (%)	415	325	250

Notes

MCM = material in accordance with the invention

CSC = material of the type described sandwiching a layer of spunbond polymeric fibres.

absorbent capacity = saturated sample weight - dry weight as a percentage of dry weight.

'Mop-up' capacity = saturated sample weight - squeezed out sample weight as a percentage, as a percentage of dry weight.

Absorbent capacity is a measure of the total saturated absorbent capacity of a wiper. 'Mop-up' capacity is a measure of the capacity of a wrung-out wiper to re-absorb water until saturated. It is also a measure of the 'wringability' of a wiper.

CONCLUSIONS

1. MCM laminate has a higher 'mop-up' capacity than 100% meltblown fabric i.e. compared to 100% meltblown fabric when wrung out, a given weight of MCM material has a higher capacity in mopping up water. This is due to the pulp content in the MCM fabric and the voids created by the presence of the pulp in the structure.
2. MCM laminate has a higher 'mop-up' capacity than a CSC laminate containing a high proportion of polypropylene polymer (70%) to have acceptable low-lint performance. This again is due to the high level of pulp in the MCM structure which can be employed without causing linting of the pulp fibres (as these are encapsulated).

The following Table illustrates by way of example the certain characteristics of three examples of material in accordance with the invention:

MELTBLOWN/COFORM/MELTBLOWN

Construction (layer by layer)	gsm	20/45/20	20/45/20	15/55/15
Embossing Pattern		DIAM	WOV WEB	DIAM
Pulp/Poly (Centre Layer) %		70/30	70/30	70/30
Caliper				
DRY	micron	900	863	999
WET	micron	899	826	976
Tensile Strength 6 x 1"				
MD DRY	g	1628	1704	1333
CD DRY	g	886	906	718
MD WET	g	1685	1721	1283
CD WET	g	879	870	683
Water Absorbency				
Rate	s	1	1	1
Capacity	%	684	565	793
Mop Up	%	472	350	558
White Spirit Absorbency				
Capacity	%	561	508	730
Mop Up	%	379	327	456
Oil Capacity				
Cap Suction	%	448	366	330
Lint	mg/sq.m	9	3	2

MD = Machine Direction
CD = Cross Direction
DIAM = Diamond
WOV WEB = Woven web

Claims

1. Non-woven laminate material, comprising a layer of meltblown polymeric microfibres intermixed with fibres of absorbent material and/or absorbent particles but excluding super absorbent particles, the absorbent fibres and/or particles being inter-connected and held captive within the polymeric microfibre matrix by mechanical entanglement and interconnection between the microfibres and absorbent fibres (when present) characterised in that the layer of meltblown polymeric microfibres and absorbent fibres and/or particles (18) is sandwiched between two outer layers (8,20) of meltblown polymeric microfibres without absorbent fibres and/or particles, the microfibres in each of the three layers being bonded to the fibres in an adjacent layer by fuse bonds (26) extending through the material and produced ultrasonically or by the application of heat or heat and pressure.

2. Non-woven material as claimed in Claim 1 wherein the polymeric material of each outer layer is made of polyester, nylon, polyethylene or polypropylene.

3. Non-woven material as claimed in Claim 1 or 2 in which the polymeric fibres of the centre layer have the same melting point as the polymeric fibres of the outer layers.

4. Non-woven material as claimed in any preceding claim having a weight of between 50gsm and 150gsm.

5. Non-woven material as claimed in any preceding claim in which at least the outer layers are treated with a surfactant to promote rapid water uptake.

6. Non-woven material as claimed in any preceding claim wherein the centre layer incorporates wood pulp or synthetic wood pulp content of between 50% and 80% by weight.

7. Non-woven material as claimed in any preceding claim in which the bond area is between 10% and 20%.

8. Non-woven material as claimed in any preceding claim in which the diameter of the microfibres in the two outer layers is between 1½ and 10 microns.

Patentansprüche

1. Nicht gewebtes, mehrschichtiges Material, das eine Schicht aus schmelzgeblasenen polymeren Mikrofasern enthält, die mit Fasern aus absorbierendem Material und/oder absorbierenden Teilchen vermischt sind, aber superabsorbierende Teilchen ausschliessen, wobei die absorbierenden Fasern und/oder Teilchen miteinander verbunden sind und in der polymeren Mikrofasermatrize durch mechanische Verschlingung und gegenseitige Verbindung der Mikrofasern und absorbierenden Fasern (wenn vorhanden) gehalten werden, dadurch gekennzeichnet, dass die Schicht aus schmelzgeblasenen polymeren Mikrofasern und absorbierenden Fasern und/oder Teilchen (18) zwischen zwei Aussenschichten (8,20) aus schmelzgeblasenen polymeren Mikrofasern ohne absorbierende Fasern und/oder Teilchen gelagert ist, wobei die Mikrofasern in jeder der drei Schichten an die Fasern in einer benachbarten Schicht durch sich durch das Material erstreckende Schmelzbindungen (26) verbunden sind, und durch Ultraschall oder durch Anwendung von Hitze oder Hitze und Druck hergestellt werden.

2. Nicht gewebtes Material nach Anspruch 1, worin das polymere Material von jeder Aussenschicht aus Polyester, Nylon, Polyethylen oder Polypropylen hergestellt ist.

3. Nicht gewebtes Material nach Anspruch 1 oder 2, in dem die polymeren Fasern der Mittelschicht denselben Schmelzpunkt wie die polymeren Fasern der Aussenschichten haben.

4. Nicht gewebtes Material nach einem der vorhergehenden Ansprüche mit einem Gewicht zwischen 50 g/m^2 und 150 g/m^2.

5. Nicht gewebtes Material nach einem der vorhergehenden Ansprüche, in dem wenigstens die Aussenschichten mit einem oberflächenaktiven Stoff behandelt werden, um schnelle Wasseraufnahme zu fördern.

6. Nicht gewebtes Material nach einem der vorhergehenden Ansprüche, in dem die Mittelschicht einen Holzzellstoff- oder synthetischen Holzzellstoffgehalt von zwischen 50 und 80 Gewichts% enthält.

7. Nicht gewebtes Material nach einem der vorhergehenden Ansprüche, in dem das Bindungsgebiet zwischen 10 und 20% ist.

8. Nicht gewebtes Material nach einem der vorhergehenden Ansprüche, in dem der Durchmesser der Mikrofasern in den beiden Aussenschichten zwischen 1½ und 10 Mikron liegt.

Revendications

1. Textile laminé non-tissé, comportant une couche de microfibres polymères soufflées en fusion mêlées à des particules absorbantes et/ou un matériau absorbant mais en excluant des particules superabsorbantes, les particules et/ou fibres absorbantes étant reliées mutuellement et maintenues captives à l'intérieur de la matrice de microfibres polymères par enchevêtrement mécanique et interconnexion des microfibres et des fibres absorbantes (lorsqu'elles sont présentes) caractérisé en ce que la couche de microfibres polymères soufflées en fusion et de particules et/ou fibres absorbantes (18) sont enserrées entre deux couches extérieures (8, 20) de microfibres polymères soufflées en fusion sans particules et/ou sans fibres absorbantes, les microfibres situées dans chacune des trois couches étant reliées aux fibres d'une couche adjacente par des liaisons de fusion (26) s'étendant à travers le textile et réalisées par ultrasons ou par application de chaleur ou par application de chaleur et de pression.

2. Textile non-tissé selon la revendication 1, dans lequel le matériau polymère de chaque couche extérieure est constitué de polyester, nylon, polyéthylène ou polypropylène.

3. Textile non-tissé selon la revendication 1 ou 2, dans lequel les fibres polymères de la couche centrale ont le même point de fusion que les fibres polymères des couches extérieures.

4. Textile non-tissé selon l'une quelconque des revendications précédentes ayant un poids compris entre 50 et 150 g/m^2.

5. Textile non-tissé selon l'une quelconque des revendications précédentes, dans lequel au moins les couches extérieures sont traitées à l'aide d'un agent tensio-actif pour améliorer l'absorption rapide de l'eau.

6. Textile non-tissé selon l'une quelconque des revendications précédentes, dans lequel la couche centrale a une teneur en pâte de bois ou pâte de bois synthétique comprise entre 50 et 80% en poids.

7. Textile non-tissé selon l'une quelconque des revendications précédentes, dans lequel la surface de liaison est de l'ordre de 10 à 20%.

8. Textile non-tissé selon l'une quelconque des revendications précédentes, dans lequel le diamètre des microfibres des deux couches extérieures est compris entre 1,5 et 10 microns.

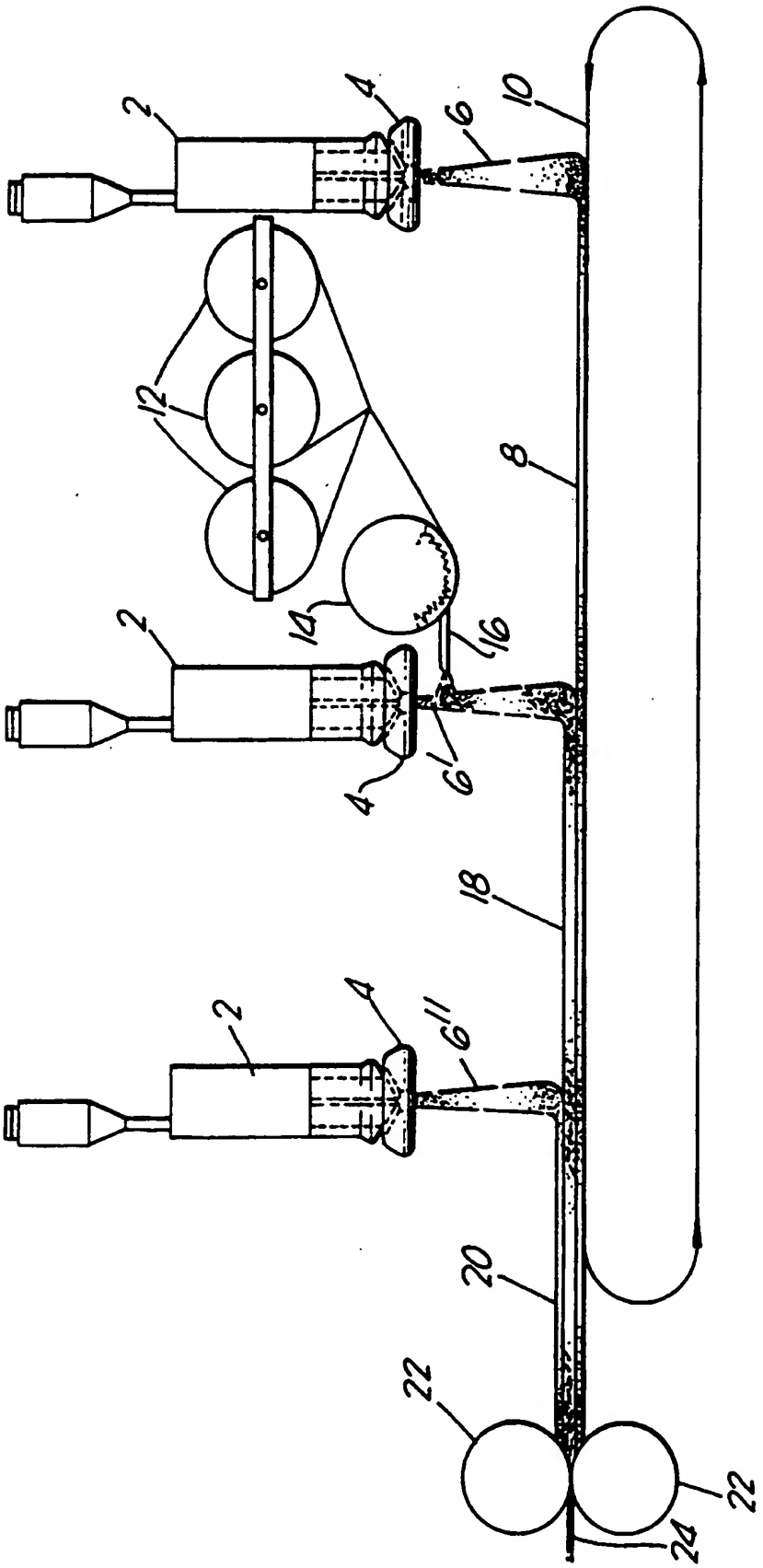
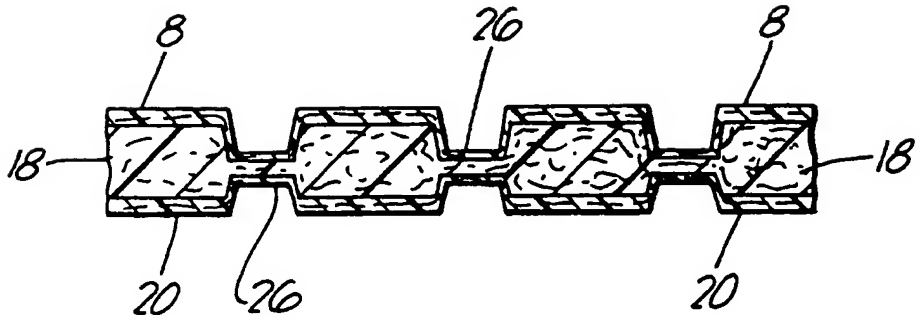


Fig. 1.

Fig. 2.



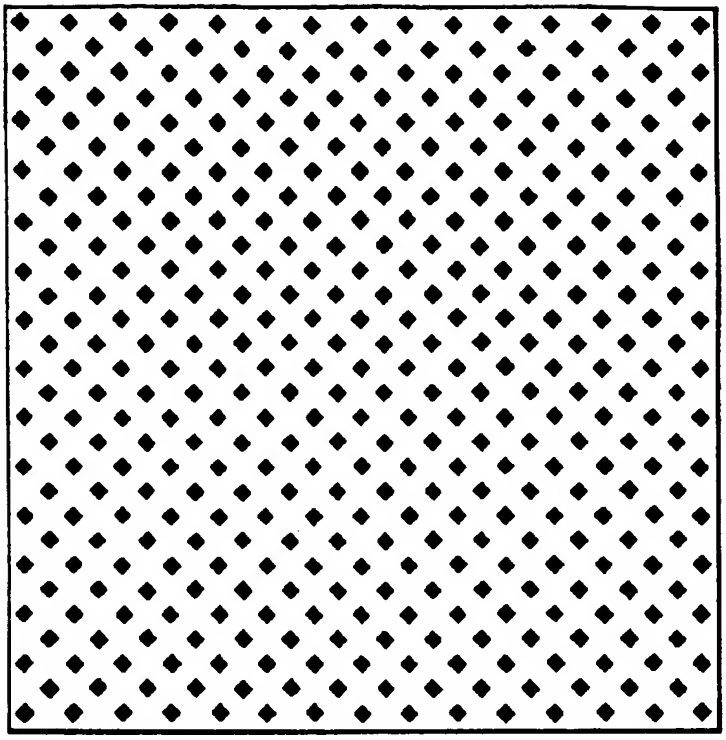


Fig.3.

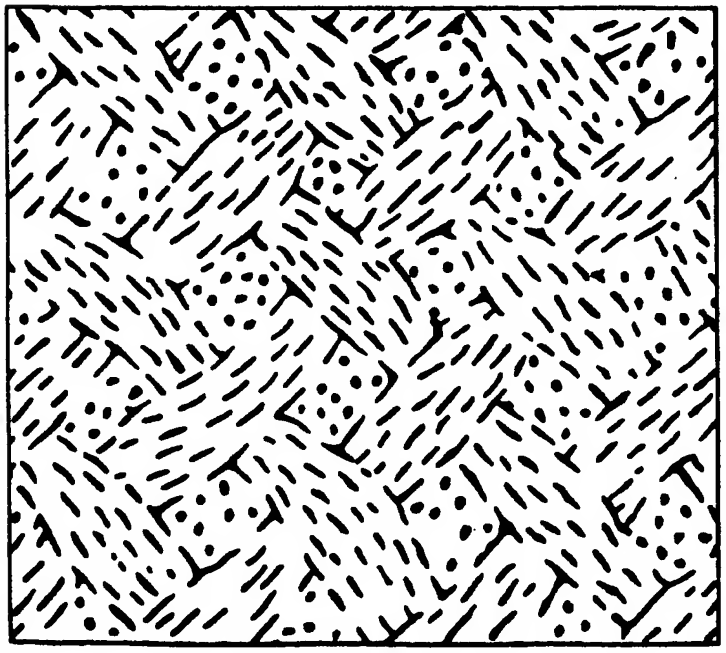


Fig.4.